

IN THE CLAIMS

1. (Previously presented) An apparatus, comprising a multiplexing unit which includes:

an optical input terminal to which can be applied an optical input signal that includes a plurality of optical component signals which are different;

an optical output terminal at which said multiplexing unit produces an optical output signal;

a plurality of protection input terminals;

a plurality of protection output terminals;

a further terminal;

a demultiplexer having an input coupled to said optical input terminal, and having a plurality of outputs, said demultiplexer being operable to optically isolate the component signals of the input signal, and to optically supply each of the isolated component signals to a respective one of said outputs thereof;

a plurality of switching units each having first and second inputs and first and second outputs, each said switching unit being capable of optically coupling said first output thereof to a selected one of said first and second inputs thereof, and being capable of optically coupling said second output thereof to a selected one of said first and second inputs thereof, wherein said outputs of said demultiplexer are each coupled to said first input of a respective said switching unit, said protection input terminals are each coupled to said second input of a respective said switching unit, and said protection output terminals are each coupled to said second output of a respective said switching unit;

a multiplexer having an output coupled to said optical output terminal, and having a plurality of inputs which are each coupled to said first output of a respective said switching unit, said multiplexer being operable to optically multiplex onto said output respective optical component signals present at each of said inputs thereof; and

a portion operable to facilitate one of: causing one of the component signals from the optical input terminal to be routed to said further terminal, and causing a component signal present at said further terminal to be included in the optical output terminal.

2. (Original) An apparatus according to Claim 1, wherein each said switching unit includes a first optical switch having first and second inputs respectively coupled to said first and second inputs of the switching unit, and having first and second outputs respectively coupled to said first and outputs of the switching unit.

3. (Original) An apparatus according to Claim 1, wherein each said switching unit includes a third output, and is capable of optically coupling said third output to a selected one of said first and second inputs.

4. (Original) An apparatus according to Claim 3, wherein said multiplexing unit includes a plurality of drop terminals, one of which is said further terminal; and wherein said portion of said multiplexing unit couples each said drop terminal to said third output of a respective said switching unit.

5. (Original) An apparatus according to Claim 3, wherein each said switching unit includes:

a first optical switch having first and second inputs respectively coupled to said first and second inputs of the switching unit, having a first output coupled to said first output of the switching unit, and having a second output; and

a second optical switch having an input coupled to said second output of said first optical switch, and having first and second outputs which are respectively coupled to said second and third outputs of the switching unit.

6. (Original) An apparatus according to Claim 1,
wherein each said switching unit includes a third input, is capable of optically coupling said first output thereof to a selected one of said first, second and third inputs thereof, and is capable of optically coupling said second output thereof to a selected one of said first, second and third inputs thereof;
wherein said multiplexing unit includes a plurality of add terminals, one of which is said further terminal; and
wherein said portion of said multiplexing unit couples each said add terminal to said third input of a respective said switching unit.

7. (Original) An apparatus according to Claim 6, wherein each said switching unit includes:
a first optical switch having first and second inputs respectively coupled to said second and third inputs of the switching unit, and having an output; and
a second optical switch having first and second inputs respectively coupled to said first input of the switching unit and said output of said first optical switch, and having first and second outputs respectively coupled to said first and second outputs of the switching unit.

8. (Original) An apparatus according to Claim 6,
wherein said multiplexing unit includes a plurality of regenerators which are each coupled between a respective output of said demultiplexer and said first input of a respective said switching unit; and
wherein said portion of said multiplexing unit includes a plurality of transponders which are each coupled between a respective said add terminal and said third input of a respective said switching unit.

9. (Original) An apparatus according to Claim 1,

wherein each said switching unit includes a third input and a third output, is capable of optically coupling said first output thereof to a selected one of said first, second and third inputs thereof, is capable of optically coupling said second output thereof to a selected one of said first, second and third inputs thereof, and is capable of optically coupling said third output thereof to a selected one of said first, second and third inputs thereof;

wherein said multiplexing unit includes a plurality of add terminals, one of which is said further terminal; and

wherein said portion of said multiplexing unit couples each said add terminal to said third input of a respective said switching unit.

10. (Original) An apparatus according to Claim 9, wherein said multiplexing unit includes a plurality of drop terminals; and wherein said portion of said multiplexing unit couples each said drop terminal to said third output of a respective said switching unit.

11. (Allowed) An apparatus, comprising a multiplexing unit which includes:
an optical input terminal to which can be applied an optical input signal that includes a plurality of optical component signals which are different;
an optical output terminal at which said multiplexing unit produces an optical output signal;
a plurality of protection input terminals;
a plurality of protection output terminals;
a further terminal;
a demultiplexer having an input coupled to said optical input terminal, and having a plurality of outputs, said demultiplexer being operable to optically isolate the component signals of the input signal, and to optically supply each of the isolated component signals to a respective one of said outputs thereof;
a plurality of switching units each having first and second inputs and first and second outputs, each said switching unit being capable of optically coupling said first output thereof to a selected one of said first and second inputs thereof, and being capable of optically coupling said second output thereof to a selected one of said first and second inputs thereof, wherein said outputs of said demultiplexer are each coupled to said first input of a respective said switching unit, said protection input terminals are each coupled to said second input of a respective said switching unit, and said protection output terminals are each coupled to said second output of a respective said switching unit;
a multiplexer having an output coupled to said optical output terminal, and having a plurality of inputs which are each coupled to said first output of a respective said switching unit, said multiplexer being operable to optically multiplex onto said output respective optical component signals present at each of said inputs thereof;
a portion operable to facilitate one of: causing one of the component signals from the input signal to be routed to said further terminal, and causing a component signal present at said further terminal to be included in the optical output signal;

wherein each said switching unit includes a third input and a third output, is capable of optically coupling said first output thereof to a selected one of said first, second and third inputs thereof, is capable of optically coupling said second output thereof to a selected one of said first, second and third inputs thereof, and is capable of optically coupling said third output thereof to a selected one of said first, second and third inputs thereof;

wherein said multiplexing unit includes a plurality of add terminals, one of which is said further terminal;

wherein said portion of said multiplexing unit couples each said add terminal to said third input of a respective said switching unit;

a first optical switch having first and second inputs respectively coupled to said second and third inputs of the switching unit, and having an output;

a second optical switch having first and second inputs respectively coupled to said first input of the switching unit and said output of said first optical switch, having a first output coupled to said first output of the switching unit, and which has a second output; and

a third optical switch having an input coupled to said second output of said second optical switch, and having first and second outputs respectively coupled to said second and third outputs of the switching unit.

12. (Original) An apparatus according to Claim 1,

wherein said further terminal functions as a drop terminal;

wherein said portion of said multiplexing unit includes an optical coupling section which is coupled between said optical input terminal and said input of said demultiplexer, and includes an optical filter which is coupled between said coupling section and said drop terminal;

wherein said coupling section supplies said optical input signal to each of said demultiplexer and said optical filter; and

wherein said optical filter extracts from said input signal and supplies to said drop terminal a respective one of said component signals of said input signal.

13. (Original) An apparatus according to Claim 12,
wherein said multiplexing unit includes an add terminal;
wherein said portion of said multiplexing unit includes a further optical coupling section which is coupled between said output of said multiplexer, said add terminal and said optical input terminal; and
wherein said further optical coupling section is operable to optically combine optical signals from said output of said multiplexer and said add terminal in order to obtain said optical output signal for said optical input terminal.

14. (Original) An apparatus according to Claim 1,
wherein said further terminal functions as an add terminal;
wherein said portion of said multiplexing unit includes an optical coupling section which is coupled between said output of said multiplexer, said add terminal and said optical input terminal; and
wherein said optical coupling section is operable to optically combine optical signals from said output of said multiplexer and said add terminal in order to obtain said optical output signal for said optical input terminal.

15. (Original) An apparatus according to Claim 1,
wherein said multiplexing unit includes a plurality of regenerators which are each coupled between a respective output of said demultiplexer and said first input of a respective said switching unit; and
wherein said portion of said multiplexer unit includes a transponder which couples said further terminal to said portion of said multiplexing unit.

16. (Previously presented) An apparatus, comprising first and second multiplexing units which each include:

- an optical input terminal to which can be applied a respective optical input signal that includes a plurality of optical component signals which are different;

- an optical output terminal at which said multiplexing unit produces an optical output signal;

- a plurality of protection input terminals;

- a plurality of protection output terminals;

- a further terminal;

- a demultiplexer having an input coupled to said optical input terminal, and having a plurality of outputs, said demultiplexer being operable to optically isolate the component signals of the input signal, and to optically supply each of the isolated component signals to a respective one of said outputs thereof;

- a plurality of switching units each having first and second inputs and first and second outputs, each said switching unit being capable of optically coupling said first output thereof to a selected one of said first and second inputs thereof, and being capable of optically coupling said second output thereof to a selected one of said first and second inputs thereof, wherein said outputs of said demultiplexer are each coupled to said first input of a respective said switching unit, said protection input terminals are each coupled to said second input of a respective said switching unit, and said protection output terminals are each coupled to said second output of a respective said switching unit;

- a multiplexer having an output coupled to said optical output terminal, and having a plurality of inputs which are each coupled to said first output of a respective said switching unit, said multiplexer being operable to optically multiplex onto said output respective optical component signals present at each of said inputs thereof; and

- a portion operable to facilitate one of: causing one of the component signals from the optical input terminal to be routed to said further terminal, and causing a component signal present at said further terminal to be included in the optical output terminal;

- wherein said protection output terminals of said first multiplexing unit are each coupled to a respective said protection input terminal of said second multiplexing unit, and

said protection output terminals of said second multiplexing unit are each coupled to a respective said protection input terminal of said first multiplexing unit.

17. (Original) An apparatus according to Claim 16,

wherein each said switching unit in each said multiplexing unit includes a third input and a third output, is capable of optically coupling said first output thereof to a selected one of said first, second and third inputs thereof, is capable of optically coupling said second output thereof to a selected one of said first, second and third inputs thereof, and is capable of optically coupling said third output thereof to a selected one of said first, second and third inputs thereof;

wherein said each multiplexing unit includes a plurality of add terminals, one of which is said further terminal; and

wherein said portion of each said multiplexing unit couples each said add terminal of that multiplexing unit to said third input of a respective said switching unit of that multiplexing unit.

18. (Original) An apparatus according to Claim 17, wherein each said multiplexing unit includes a plurality of drop terminals; and wherein said portion of each said multiplexing unit couples each said drop terminal of that multiplexing unit to said third output of a respective said switching unit of that multiplexing unit.

19. (Previously presented) A method of multiplexing optical signals in a multiplexing unit which includes an optical input terminal, an optical input terminal, a plurality of protection input terminals, a plurality of protection output terminals, a further terminal, and a plurality of switching units that each have first and second inputs and first and second outputs, comprising the steps of:

receiving at the optical input terminal an optical input signal which includes a plurality of optical component signals that are different;

optically demultiplexing the input signal to isolate respective component signals thereof;

supplying each of the isolated component signals to the first input of a respective one of the switching units;

operatively coupling each of the protection input terminals to the second input of a respective one of the switching units;

operatively coupling each of the protection output terminals to the second output of a respective one of the switching units;

causing each of the switching units to optically couple at least one of the outputs thereof to a selected one of the inputs thereof;

optically multiplexing the optical signals from the second outputs of the switching units to produce a multiplexed signal;

supplying to said optical output terminal an optical output signal which is based on said multiplexed signal; and

carrying out one of the steps of: causing one of the component signals from the optical input terminal to be routed to said further terminal, and causing a component signal present at said further terminal to be included in the optical output terminal.

20. (Original) A method according to Claim 19,
wherein each of the switching units includes a third input and a third output, and the multiplexing unit includes a plurality of add terminals which are each coupled to the third input of a respective one of the switching units, the further terminal being one of the add terminals ; and

wherein said causing step is carried out by causing each of the switching units to optically couple at least one of the first, second and third outputs thereof to a selected one of the first, second and third inputs thereof.

21. (Previously presented) A network element, comprising:
a demultiplexer and a multiplexer operable to be coupled to a span of an optical network;

a plurality of switches coupled between the demultiplexer and the multiplexer, the switches each operable to switch to another span of an optical signal from the demultiplexer and to at least selectively pass the signal to the multiplexer; and

a splitter coupled to the demultiplexer, the splitter operable to drop a signal including a plurality of component signals and to supply the signal to the demultiplexer.

22. (Previously presented) The network element of Claim 21, further comprising a second splitter coupled to the multiplexer, the second splitter operable to add an add signal to a multiplexed signal generated by the multiplexer.